



# The UK Biobank

A project to support long-term prospective studies of genes and the environment and their relationship to health and illness in 500,000 participants

# The “New Genetics”



# The post-genome challenge

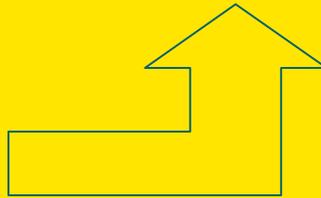
“We should be interested in humanity’s genes rather than the human genome, moving from the individual towards the population”

*Sydney Brenner*

20th Century  
knowledge:

Smoking causes  
lung cancer

Genome sequences



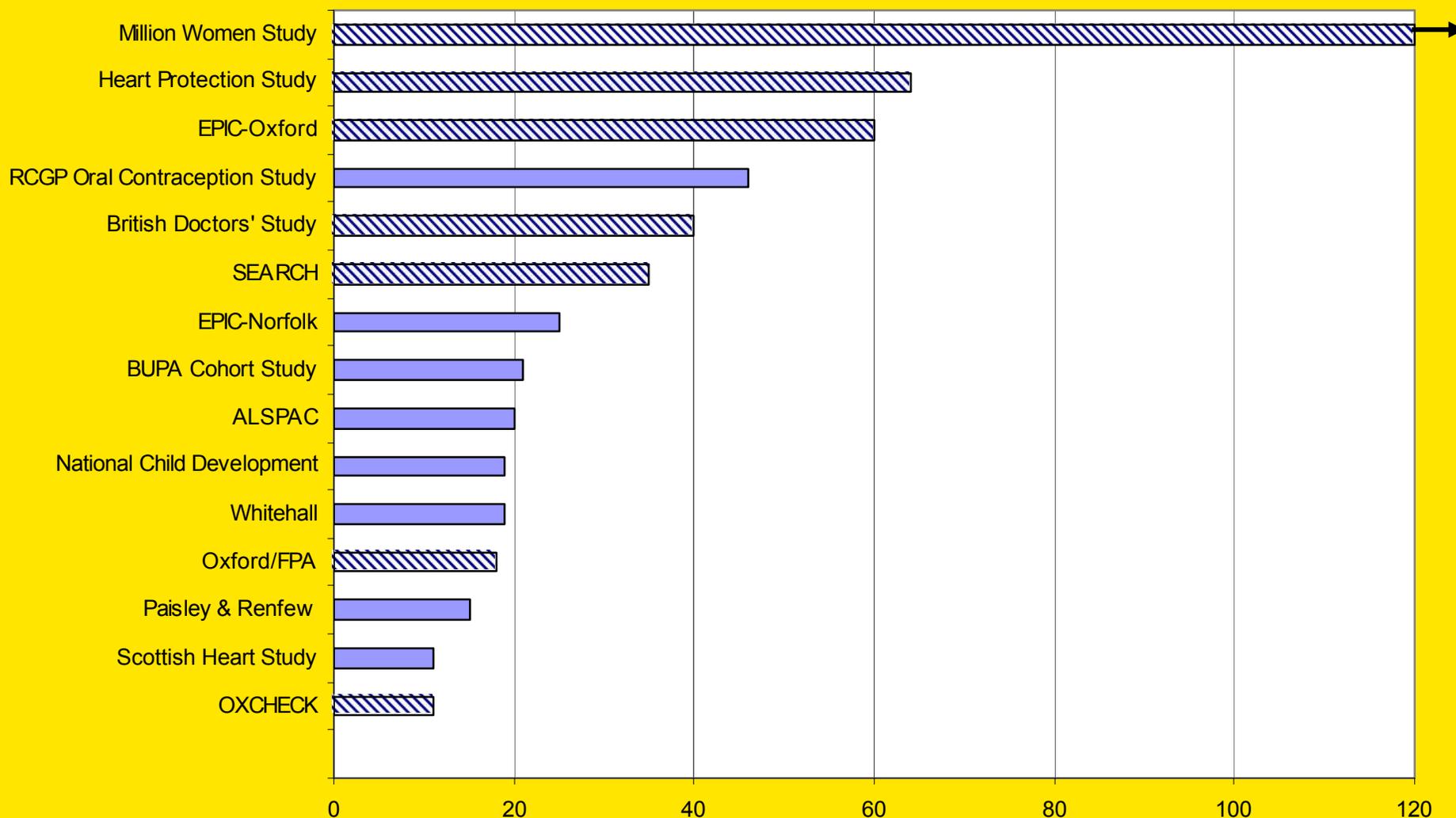
21st Century question:

Which HRT users will develop  
breast cancer and why?

“Quantity has a quality all of its own”

Henry Ford

# UK COHORT STUDIES (>10,000 participants)



Cohort size (thousands)



Smaller UK studies: Regional Heart Study 8000; 1946 Birth Cohort 5000; Caerphilly & Speedwell 4000; Ely study 2000.



## Recruitment

500,000  
participants  
aged 40-69



## Data & Sample storage

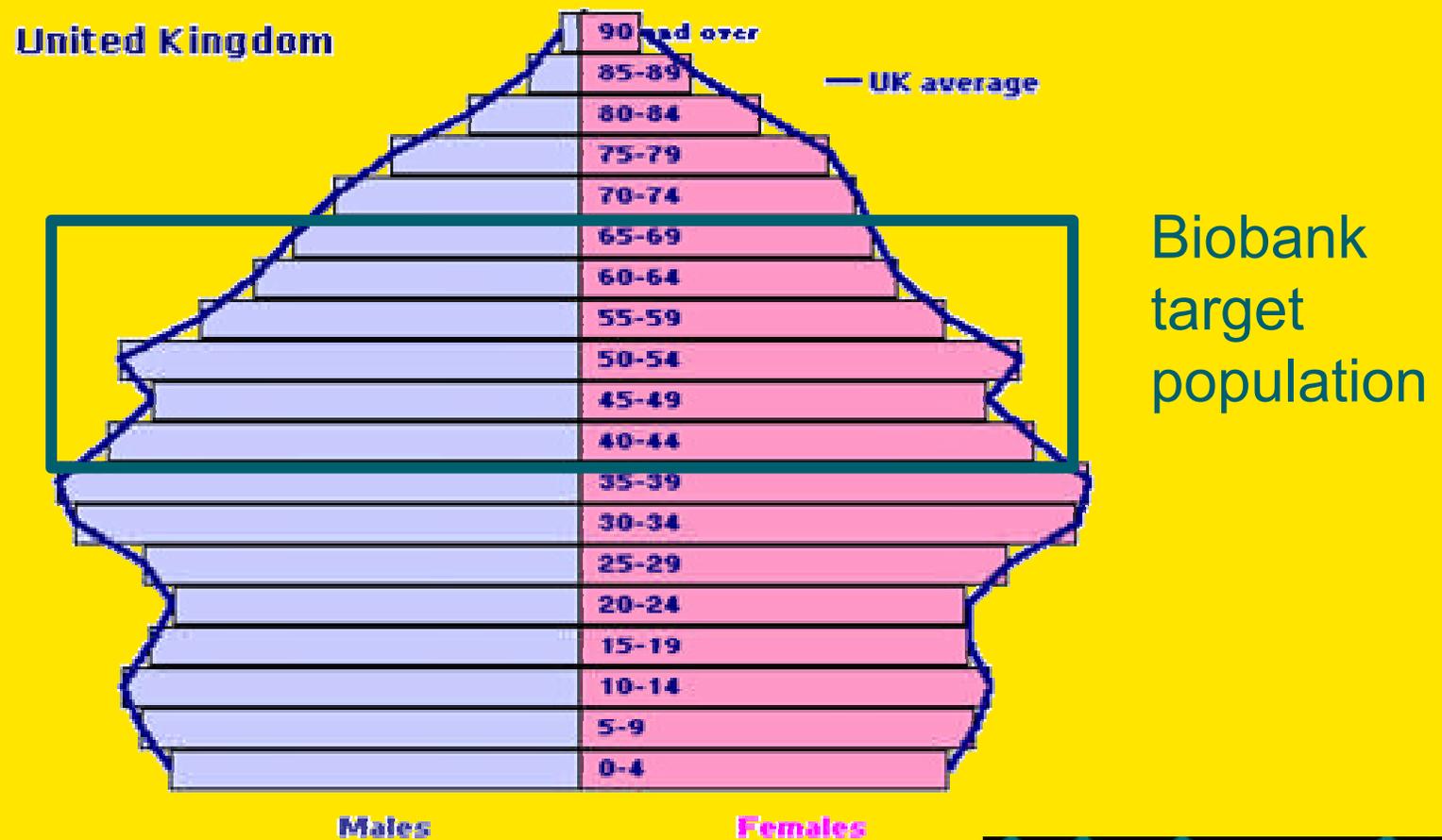
Environmental  
exposure  
Physiological  
variables  
Neuropsychiatric  
evaluation  
Biochemical markers  
DNA, plasma, urine



## Follow-up

Record linkage  
Registries  
GP records  
Hospital admissions  
Cancer registries  
Prescriptions  
Death

# UK population 2001



# Likely Prevalence at baseline

8,000 IHD

131,000 Chol >5

7,000 Diabetes

75,000 High BP

6,500 CerebroVascD

46,000 Obese

3,500 COPD

20,000 Low FEV<sub>1</sub>

1,600 Parkinson's

19,000 low GHQ12

1,700 RA

# Scientific Objectives

- Determine separate and combined effects of genes and environment on common causes of health and illness
  - Nested case-control studies
  - Prevalence studies
  - Cohort studies (exposure based)
- Genotype-driven clinical investigation
- Biomarker detection as markers or risk factors

# Scientific Justification for Prospective Studies

- Genetic information is available for all cases regardless of severity
- Measurement of blood based molecular and proteomic factors using samples collected prior to onset
- A resource where investigation of unforeseen outcomes and relationships is possible
- A resource for studying the determinants of health as well as disease

# General Benefits of UK Biobank

1. Public Health - Measure the effect of environmental, lifestyle and genetic risk factors in populations
2. Clinical Medicine - Understand heterogeneity within disease groups
3. Bioscience - Identify important biomarker-disease associations

## **Additional benefits**

Promote high standards for ethics and governance in this field

Broaden access to expensive research resources

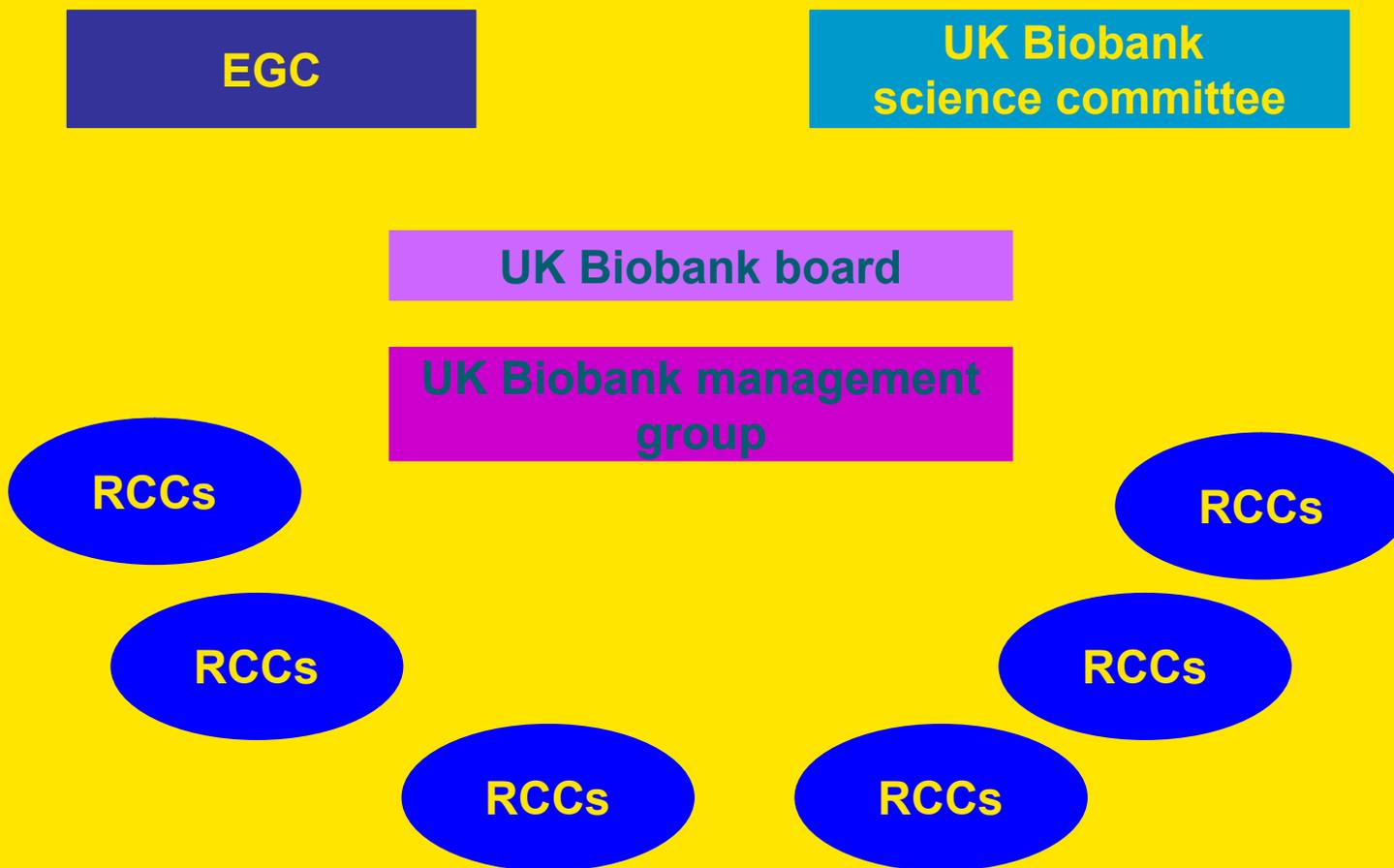
Opportunities to collaborate internationally

Efficient and economic approach

# How is UKBiobank funded?



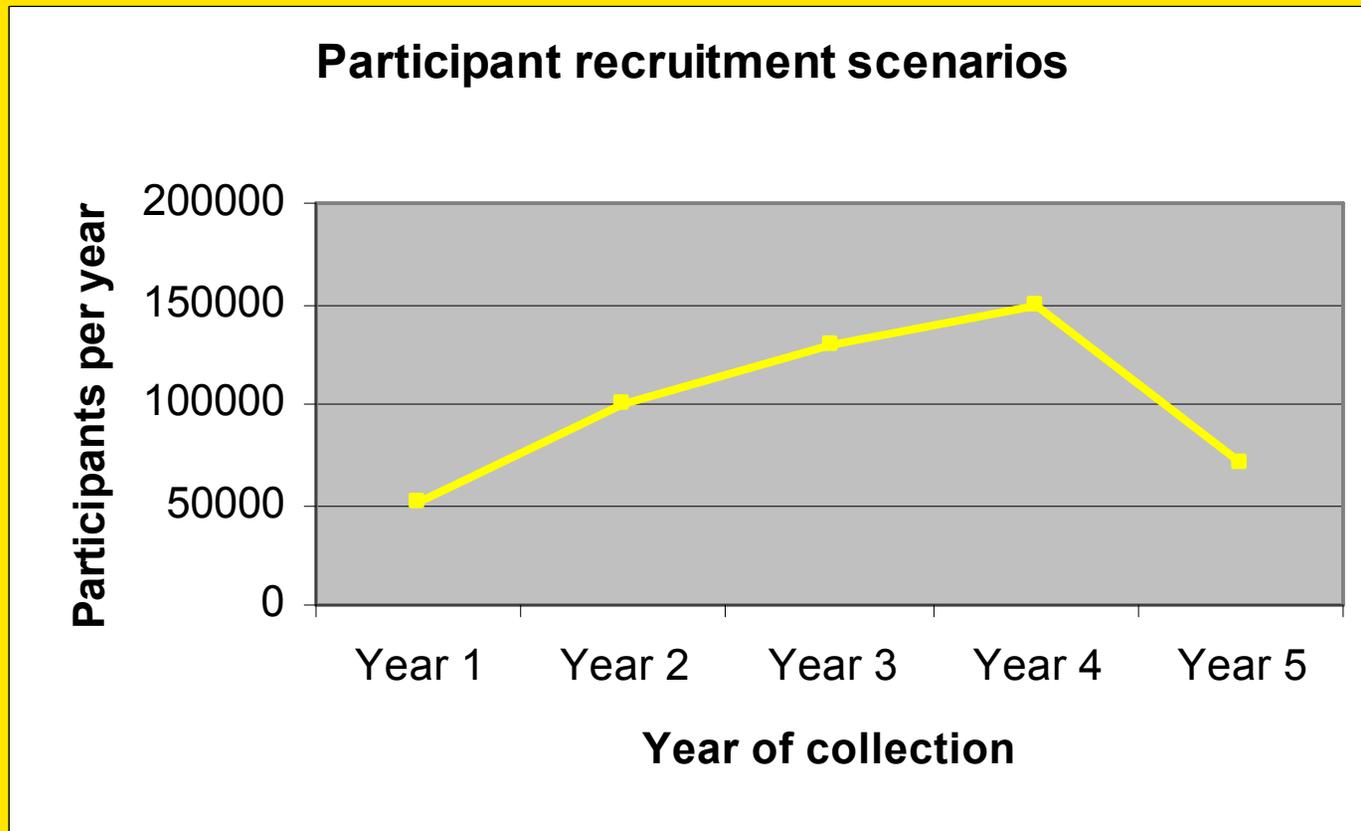
# How has UK Biobank been established?



# The Approach

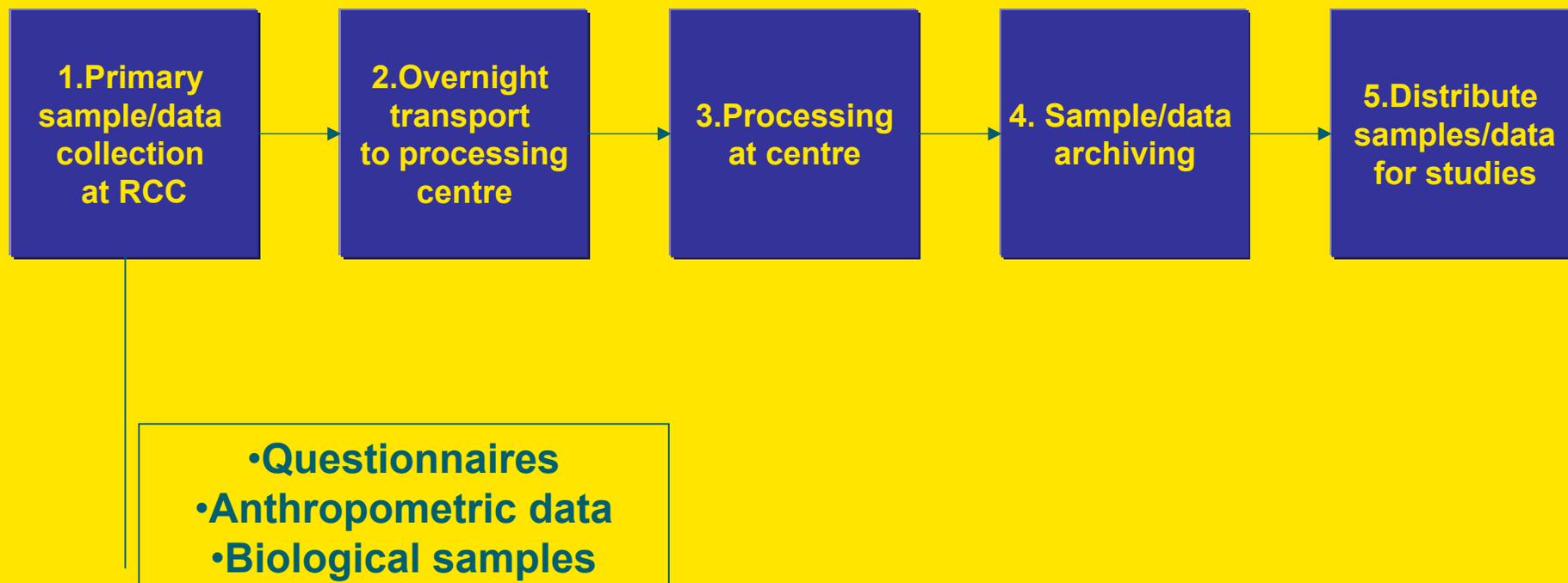
- Modern, efficient methodology in patient recruitment, data collection, IT, genotyping, LIMS and genomics
- Industrial scale processes, process and project planning, and quality assurance
- Distributed scientific collaboration – strong central co-ordination and quality control

# The project is being designed with an accelerating recruitment plan....

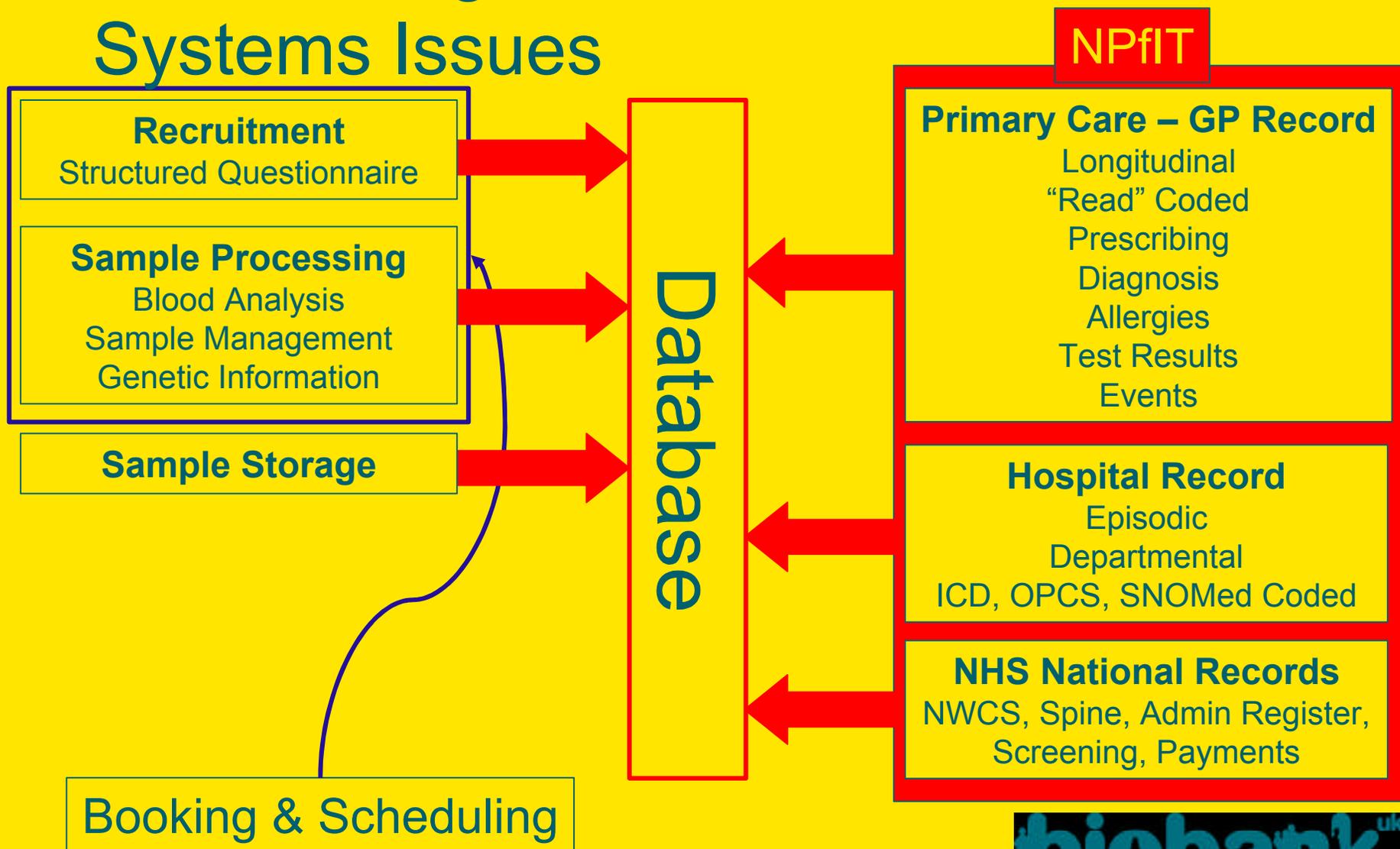


- Different recruitment settings will be used throughout the project
- We will balance coverage vs. cost vs. quality control

# Participants will come to assessment centres.....



# Data Management & Systems Issues



# Samples will be collected from each participant

Spray-dried K<sub>2</sub>EDTA (plastic)

Acid citrate dextrose additives (ACD)

Clot activator and gel for serum separation

Plastic Conical Urinalysis

- 750 participants per day
- 3750 tubes of blood
- 750 tubes of urine

- 14 million 1ml tubes
- 10 million 50ul tubes



4°C Transport

RT Transport

4°C Transport

Glucose

RT Transport

Plasma, Buffy coat, DNA (FTA), RBCs, cell counts

Plasma, Buffy coat, PBLs,

Serum blood chemistry

Urine Metabolites Bioanalytes

## Liquid nitrogen storage facility



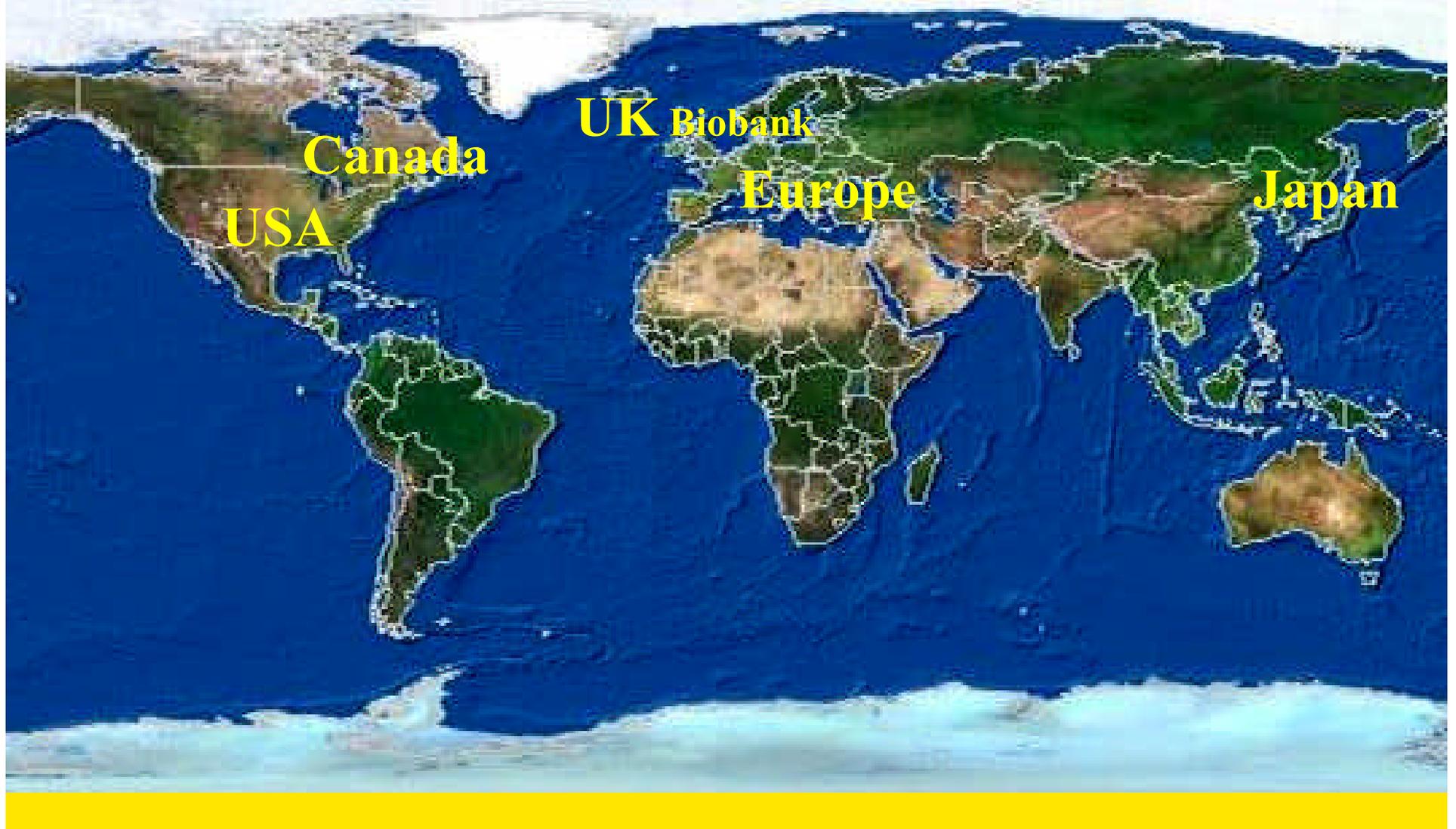
# Sample storage: automated retrieval at -80 degrees



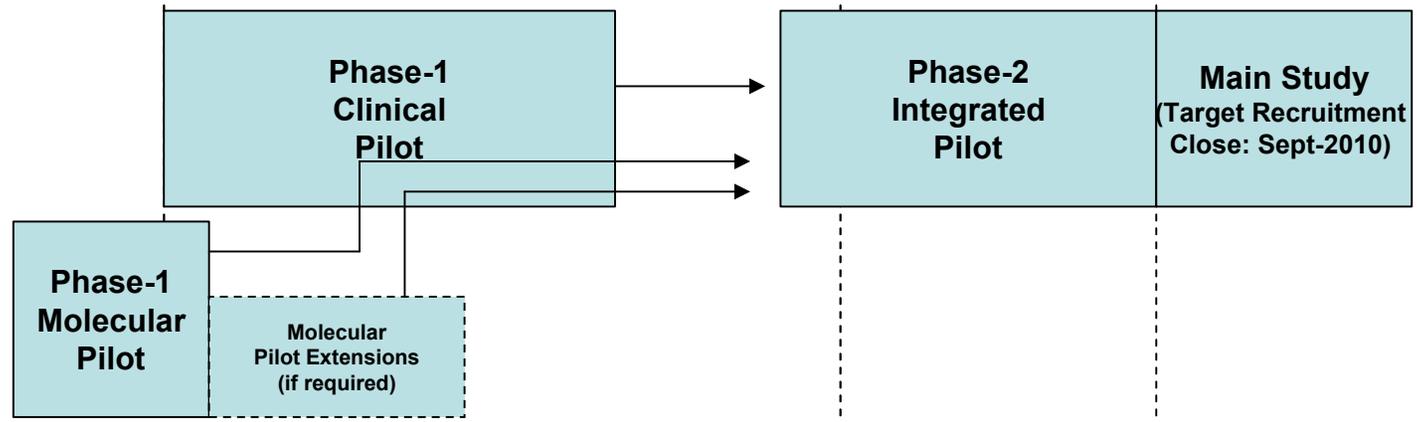
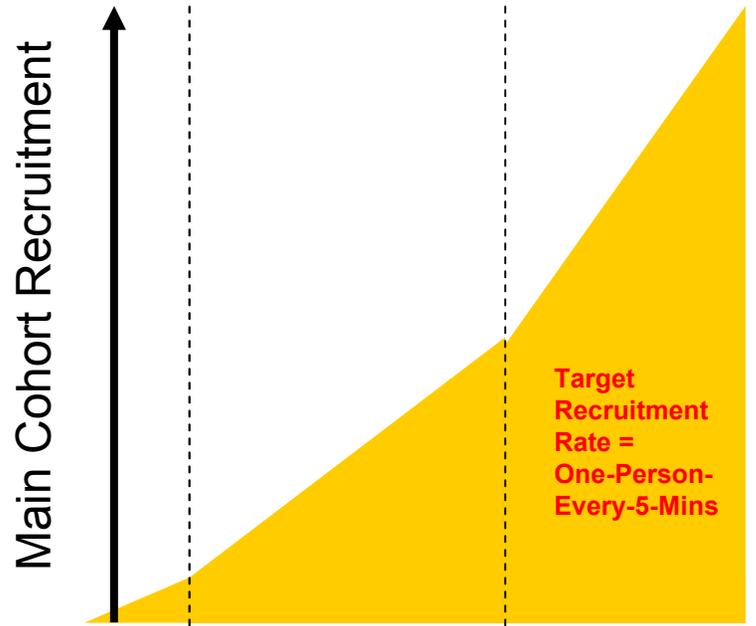
# Ethical and Governance Framework

- Volunteers can withdraw at anytime
- Broad consent to future use
- Data security + confidentiality assured
- Samples not released to others
- Full access for appropriate purposes
- Internal and external review of science and ethics
- Independent Ethics and Governance Council

# The need for collaboration



**UK Biobank  
Pilot Studies  
Strategy**



Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
2004			2005									2006					

# Current activities

- Piloting the clinical and molecular processes
- Establishing the IT infrastructure and clinical applications
- Developing the communications strategy to support recruitment
- Writing the scientific protocol and participant questionnaire
- Refining the Ethics and Gov. Framework
- Implementing the laboratory facilities and processes

# Site of the automated storage facility



# Challenges

- Delivery against project timelines in a distributed organization
- Ensuring ethical approvals for complex studies
- Negotiating access to required information
  - To invite and maintain contact with participants
  - To access longitudinal and secondary data sources
- Ensuring continuity and security of data chain over many years

# UK Biobank special features...

- Size of project (persons x time)
- Biological resource for study of biomarkers and genes
- Recall of subsets for intensive phenotyping
- Extensive use of routine health records
- Ethical approach – public participation



# Towards an IP and Access policy

- An open resource
- Managed to optimise its use and value for research in the public interest
- Appropriate safeguards and controls

# Safeguards?

- Honour commitments to participants
- Ensure compliance with legal and regulatory requirements
- Prioritise access to depletable resources
- Manage IP rights appropriately